NON-PUBLIC?: N
ACCESSION #: 9410040259
LICENSEE EVENT REPORT (LER)

FACILITY NAME: HOPE CREEK GENERATING STATION PAGE: 1 OF 7

DOCKET NUMBER: 05000354

TITLE: Reactor Protection System and Engineered Safety Actuation:
Safety Auxiliaries Cooling System isolation actuation and
subsequent reactor scram.
EVENT DATE: 08/30/94 LER #: 94-012-00 REPORT DATE: 09/29/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Lou Aversa, Senior Staff Engineer - TELEPHONE: (609) 339-3386
Technical

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS: no

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On Tuesday, August 30, 1994, with the plant operating at 100% power, Maintenance department personnel were performing 24 month environmental qualification preventive maintenance on a fuel pool heat exchanger motor operated valve. During the course of the inspection, at the valve operator, a short circuit occurred which caused a trip of the logic system for the associated channel. The loss of the logic power resulted in a partial isolation of the "A" Safety Auxiliaries Cooling System (SACS) which was supplying the Turbine Auxiliaries Cooling System (TACS) at the time of the event. This resulted in a loss of cooling water to the turbine-generator coolers as well as other nonessential loads. The "B" SACS loop auto initiated per design to supply TACS, but due to the incomplete isolation of the "All SACS loop, the "B" SACS loop isolated on low head tank level as water transferred from the "Bit to "All head

tanks. A turbine-generator load runback resulted from the loss of cooling followed by a reactor scram on high pressure (1037 PSIG). Following the scram operators were able to restore the "A" SACS loop to supply TACS. The root causes of this event were an incorrectly sized fuse in a logic module and failure of the standby SACS loop to supply TACS loads. Corrective actions included installing the proper size fuse, a check of the components downstream of the oversized fuse, work practice changes regarding both fuse replacement and energized work. Additionally a design review of the SACS transfer scheme will be conducted, as well as a review of this event during continuing training with all departments involved in this event.

END OF ABSTRACT

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)
Reactor Protection System (SB) EEIS Identifier (BH)
Safety Auxiliaries Cooling System (EG) EEIS Identifier (CC)

IDENTIFICATION OF OCCURRENCE

TITLE (4): Reactor Protection System and Engineered Safety System Actuation - Safety Auxiliaries Cooling System isolation actuation and subsequent reactor scram.

Event Date: 8/30/94
Event Time: 0943
This LER was initiated by Incident Report No. 94-142

CONDITIONS PRIOR TO OCCURRENCE

Plant in OPERATIONAL CONDITION 1 (Power Operation)
Reactor Power 100% of rated, 1092 MWe

DESCRIPTION OF OCCURRENCE

On Tuesday, August 30, 1994, with the plant operating at 100% power, Main
enance department personnel were performing 24 month environmental qualification preventive maintenance on a fuel pool heat exchanger motor operated valve. The valve's operator power supply had been turned off and tagged prior to the start of work, with the logic power remaining energized which is in accordance with station administrative procedures.

During the course of the inspection, at the valve operator, a short circuit occurred which caused a trip of the logic system for the associated channel. The loss of the logic power resulted in a partial isolation of the "A" Safety Auxiliaries Cooling System (SACS) which was supplying the Turbine Auxiliaries Cooling System (TACS) at the time of the event. This resulted in a loss of cooling water to the turbine-generator coolers as well as other nonessential loads. The "B" SACS loop auto initiated per design to supply TACS, but due to the incomplete isolation of the "A" SACS loop, the "B" SACS loop isolated on low head tank level as water transferred from the "B" to "A" head tanks. Control Room Operators (NCO -RO licensed) and the Senior Nuclear Shift Supervisor (SNSS - SRO licensed) made an announcement to terminate all testing when the initial loss of TACS occurred. The NCO noticed that the indicating lights for the "A" SACS pump and associated valves were extinguished and assumed the pump was out of service and the valves were isolated. Following the loss of the "B" SACS loop the SNSS directed the control room personnel to override the "B" loop isolation when the "B" loop head tank was recovering. The supply isolation valves were manually jacked open causing head tank level to decrease to zero percent. The SNSS ordered the valves closed to protect the integrity of the "B" SACS loop. As attempts were being made to restore TACS cooling a turbine generator runback on stator water cooling high temperature occurred which reduced the turbine

DESCRIPTION OF OCCURRENCE

generator output and initiated a reactor recirculation system runback. The turbine bypass valves had automatically opened and operators began inserting control rods attempting to maintain reactor pressure, but reactor power and steam flow still exceeded the capacity of the bypass valves and turbine load and a scram occurred on a high pressure signal (1037 PSIG). Following the scram operators were able to restore the "A" SACS loop to supply TACS.

ANALYSIS OF OCCURRENCE

The Turbine Auxiliary Cooling System (TACS) is a closed loop cooling system which supplies all turbine-generator cooling loads and other support systems such as non-essential chillers, air compressors and feedpump coolers. The system is supplied via the Safety Auxiliaries Cooling System (SACS) through redundant isolation valves which separate the safety and non safety related portions of the system (see attached drawing). The flow requirement for TACS requires two pumps running in the SACS loop which is supplying TACS. If a low flow is sensed in the

TACS supply line, the standby SACS loop will auto start and supply TACS. The SACS subsystems will isolate TACS if a low head tank level is sensed in the respective "A" or "B" SACS head tank and on a SACS pump trip.

The turbine-generator is designed to runback on a loss of stator cooling to the main generator. When stator cooling temperature reaches 82 degrees C a turbine runback is initiated to reduce stator field amps to less than 24% of rated amps. A reactor recirc runback to minimum is also initiated on the loss of stator cooling. This in conjunction with operators inserting control rods should reduce reactor power and steam flow to a level which can be supported with combined steam loads through the turbine running at the reduced level and full opening of the bypass valves.

Each of the redundant safety related SACS channels are designed with dedicated power supplies for all components such as pumps and valves. Each component is powered through an individual breaker with individual control power supplies. The control logic for all the components on each channel is routed in a common logic cabinet for each channel. The logic cabinet 125 VDC power supply is routed through a 1.5 amp fuse, while the individual logic modules for each component on the channel, are supplied via a 0.75 amp fuse.

The work being performed by maintenance personnel, which initiated this event, was performed in accordance with approved station practices. It is typical that only the motive power and control power is isolated when valves are removed from service and cleared for maintenance. The logic power is typically left energized as there is some risk with inadvertent actuations when logic power is removed and restored. During the course of the maintenance activities at the valve actuator, a short circuit occurred which should have only blown the individual

logic module power supply fuse for the valve being worked and not the entire logic cabinet. Investigation of the event determined that an incorrectly sized fuse was found in the valve circuit fuse module. In February of 1994, maintenance technicians had changed the fuse in this logic module to correct a loss of control room indication for an associated valve. A review of the work order utilized in February indicated that the technician had incorrectly installed a 1.5 amp fuse at that time. As a result of a 1.5 amp fuse being installed at the module, the short circuit current was sensed at the cabinet power supply 1.5 amp fuse which blew, thereby de-energizing the entire logic cabinet.

A partial isolation of the "A" SACS loop resulted when the logic cabinet lost power. The hydraulically operated TACS supply valve for the "A" SACS channel failed closed, however, the motor operated return isolation valves remained open (fail as is per design on loss of logic power). This allowed the two SACS loops to be cross connected via the common TACS return header. The "A" channel SACS pump continued to operate, but as a result of the "A" valve isolating, a cooling water low flow to TACS was sensed and the B SACS loop auto started. The "B" SACS loop started and the TACS supply isolation valves opened; however, the "B" SACS loop return isolation valves from TACS do not reposition as quickly and the return water began flowing to the unisolated "A" loop. The "B" SACS loop head tank level decreased to the TACS isolation setpoint and isolated TACS. Operators maximized make-up flow to the head tank. When head tank level was seen to be recovering, the operators attempted to restore TACS from the "B" SACS loop by manually jacking the supply isolation valves open. As the "A" SACS loop was only partially isolated, the "B" SACS head tank level decreased. Seeing this response, the SNSS ordered the TACS isolation valves closed terminating the level decrease. The SACS to TACS subsystem isolation valves will isolate on low head tank level, Loss of Coolant Accident signals, or when their associated SACS pump trips. As none of these conditions existed, water from the "B" SACS loop transferred to the "A" SACS loop through the unisolated return isolation valves.

The turbine-generator runback circuit operated per design. As operators were attempting to restore TACS flow, a high stator cooling system temperature initiated a turbine and reactor recirculation pump runback. The system is designed to reduce generator output to a point where stator temperatures can be maintained without forced cooling. The reactor recirculation system is runback to minimum to reduce power and steam flow to near the capacity of the bypass valves, auxiliary steam loads and the reduced steam flow to the turbine. In conjunction with the runback, operators began inserting control rods to further reduce reactor power and steam flow; however, due to the rate at which the turbine runback occurred, reactor power and steam flow could not be reduced sufficiently to avert the reactor scram on high pressure.

ANALYSIS OF OCCURRENCE (Con't)

The loss of logic power also affected the capability to remotely operate several other components controlled from "A" channel. Control and indication, from the main control room, for the "A" SACS cooling water isolation valves to the fuel pool heat exchangers and residual heat

removal heat exchanger was lost. The "A" standby liquid control pump and squib valve lost auto start capability. All redundant equipment was operable during this event. The loss of logic power also resulted in an invalid isolation of the reactor water clean-up system.

SAFETY SIGNIFICANCE

This incident posed minimal safety significance as SACS was capable of performing its safety related functions throughout the event.

PREVIOUS OCCURRENCES

There has been no previous reportable occurrences of a scram due to a generator runback and loss of TACS.

APPARENT CAUSE OF OCCURRENCE

The initiating cause of this event was the incorrectly sized fuse which caused a loss of the "A" channel logic cabinet. The root cause of the turbine runback and subsequent scram was the failure of the SACS system to automatically transfer TACS to the standby loop. The design intent of the SACS loop automatic transfer is to successfully transfer TACS to the standby SACS loop, and maintain cooling to all turbine auxiliaries, during this type of event. Operators failing to recognize that the "All loop had not completely isolated, due to a loss of multiple indications, while attempting to restore the "B" SACS to TACS isolation was a contributing factor to the scram.

CORRECTIVE ACTIONS

The correct size fuse was installed in the logic module.

A functional test and inspection of the components and circuits downstream of the oversized fuse was conducted. The inspection revealed a damaged conductor within the valve operator where the short circuit occurred. The conductor was repaired and the system tested satisfactorily.

A review of the design drawings confirmed that all plant systems and the TACS isolation valves responded per design for the conditions experienced in this event.

A review of the work order system, for work orders which identified fuse replacements for the affected size fuses, was performed to verify that correct size and type fuses were installed. one additional fuse replacement error was noted and corrected.

CORRECTIVE ACTIONS

A root cause investigation into the fuse replacement errors determined that personnel had not fully implemented standard practices that are expected when fuse replacements are required. Maintenance department is preparing a detailed fuse replacement procedure which will detail the required steps that are currently in place but are implemented via standard work practices.

Planning department is conducting a review of component design drawings to determine instances where logic power is routed to the valve actuator independent of the normal control power feed. All similar valve operators that contain live circuits following tagging of the actuat
r
and control power supply will be identified on the work order.

Procedures for coping with a loss of TACS will be evaluated and revised as necessary to provide detailed actions for placing the standby loop in service manually.

Maintenance department has conducted lessons learned training with department personnel relating to this event. This event will be reviewed again during operating experience feedback sessions.

All operating crews were briefed on the details of the transient and lessons learned from this event.

The Hope Creek simulator response for loss of stator cooling is being compared to plant data obtained during this event to ensure fidelity and appropriate training will be conducted during future requalification sessions.

Engineering will review the adequacy of the SACS transfer scheme to determine if Changes are warranted to preclude this type of event.

Sincerely,

R. J. Hovey
General Manager
Hope Creek Operations

LAA/

Attachment
SORC Mtg. 94-065
C Distribution

TEXT PAGE 7 OF 7

ATTACHMENT 1 "SACS/TACS FLOW DIAGRAM" omitted.

ATTACHMENT TO 9410040259 PAGE 1 OF 1

PSE&G

Public Service Electric and Gas Company P. O. Box 236 Hancocks Bridge, New Jersey 08038

Hope Creek Generating Station

September 29, 1994

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
UNIT NO. 1
LICENSEE EVENT REPORT 94-012-00

This Licensee Event Report is being submitted pursuant to the requirements of 10CFR 50.73(a)(2)(iv).

Sincerely,

R. J. Hovey
General Manager -
Hope Creek Operations

LAA/

Attachment
SORC Mtg. 94-065
C Distribution

The Energy People

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